

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX T <sub>C</sub> = +25°C
-40V	10mΩ @ V <sub>GS</sub> = -10V	-76A
	14mΩ @ V <sub>GS</sub> = -4.5V	-58A

## Description

This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

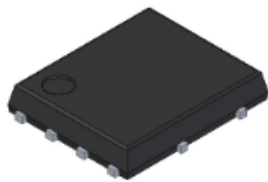
- DC-DC Converters
- Power Management Functions
- Analog Switch

## Features and Benefits

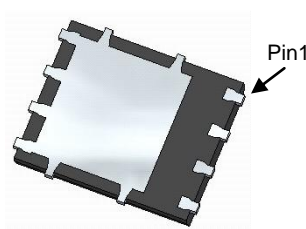
- 100% Unclamped Inductive Switch (UIS) Test In Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DMP4011SPSQ is suitable for automotive applications requiring specific change control and is AEC-Q101 qualified, is PPAP capable, and is manufactured in IATF16949:2016 certified facilities.**

## Mechanical Data

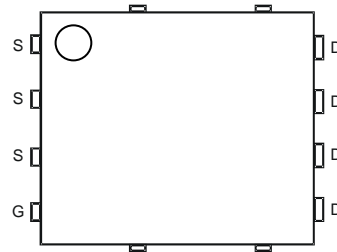
- Case: PowerDI<sup>®</sup> 5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – 100% Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.097 grams (Approximate)



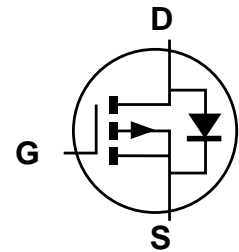
Top View



Bottom View



Top View  
Pin Configuration



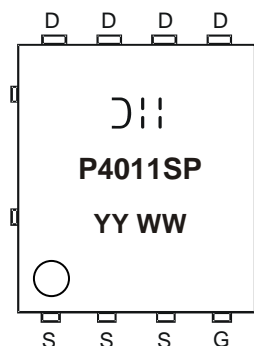
Internal Schematic

## Ordering Information (Note 4)

Part Number	Case	Packaging
DMP4011SPSQ -13	PowerDI5060-8	2,500 / Tape & Reel

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free/](http://www.diodes.com/quality/lead_free/) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



∽|| = Manufacturer's Marking  
 P4011SP = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 19 = 2019)  
 WW = Week (01 to 53)

**Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Drain-Source Voltage		$V_{DSS}$	-40	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Continuous Drain Current $V_{GS} = -10\text{V}$ (Note 7)	Steady State	$T_C = +25^\circ\text{C}$	-76	A
		$T_C = +70^\circ\text{C}$	-61	
Continuous Drain Current $V_{GS} = -10\text{V}$ (Note 6)	Steady State	$T_A = +25^\circ\text{C}$	-11.7	A
		$T_A = +70^\circ\text{C}$	-9.4	
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)		$I_{DM}$	-300	A
Maximum Body Diode Continuous Current (Note 6)		$I_S$	-8.9	A
Pulsed Source Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)		$I_{SM}$	-300	A
Avalanche Current (Note 8) $L = 1\text{mH}$		$I_{AS}$	-22	A
Avalanche Energy (Note 8) $L = 1\text{mH}$		$E_{AS}$	250	mJ

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$	$P_D$	1.3	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	96.4	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$	$P_D$	2.3	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	55	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	1.3	$^\circ\text{C/W}$
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 9)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-40	—	—	V	$V_{GS} = 0\text{V}, I_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	-1	$\mu\text{A}$	$V_{DS} = -32\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 9)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-1.0	-1.9	-2.5	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	6	10	m $\Omega$	$V_{GS} = -10\text{V}, I_D = -9.8\text{A}$
		—	10	14		$V_{GS} = -4.5\text{V}, I_D = -9.8\text{A}$
Diode Forward Voltage	$V_{SD}$	—	-0.7	-1	V	$V_{GS} = 0\text{V}, I_S = -1\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 10)</b>						
Input Capacitance	$C_{iss}$	—	2747	—	pF	$V_{DS} = -20\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	508	—		
Reverse Transfer Capacitance	$C_{rss}$	—	222	—		
Gate Resistance	$R_g$	—	21.4	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = -4.5\text{V}$ )	$Q_g$	—	25	—	nC	$V_{DS} = -20\text{V}, I_D = -9.8\text{A}$
Total Gate Charge ( $V_{GS} = -10\text{V}$ )	$Q_g$	—	52	—		
Gate-Source Charge	$Q_{gs}$	—	8.5	—		
Gate-Drain Charge	$Q_{gd}$	—	11.8	—		
Turn-On Delay Time	$t_{D(ON)}$	—	6.6	—	ns	$V_{GS} = -10\text{V}, V_{DD} = -20\text{V}$ $R_g = 6\Omega, I_D = -1\text{A}$
Turn-On Rise Time	$t_R$	—	6.5	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	222	—		
Turn-Off Fall Time	$t_F$	—	138	—		
Reverse Recovery Time	$t_{RR}$	—	25	—	ns	$I_F = -9.8\text{A}, di/dt = -100\text{A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{RR}$	—	17	—	nC	$I_F = -9.8\text{A}, di/dt = -100\text{A}/\mu\text{s}$

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.

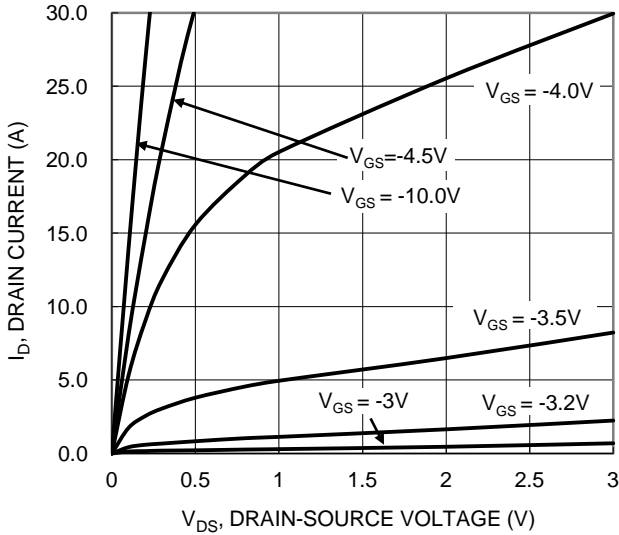


Figure 1. Typical Output Characteristic

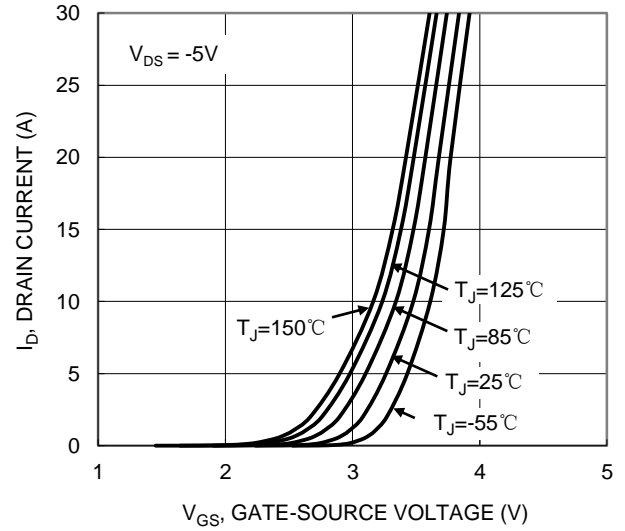


Figure 2. Typical Transfer Characteristic

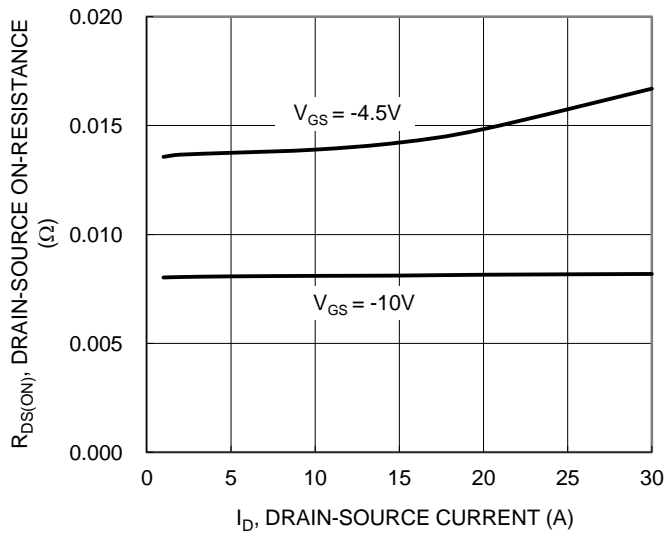


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

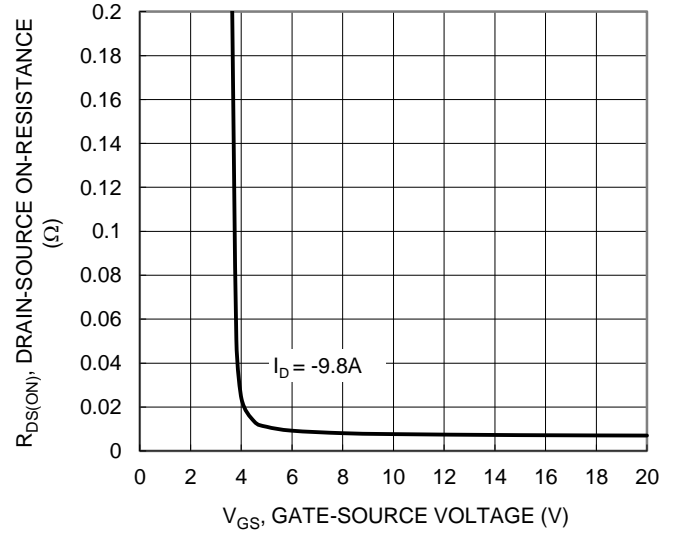


Figure 4. Typical Transfer Characteristic

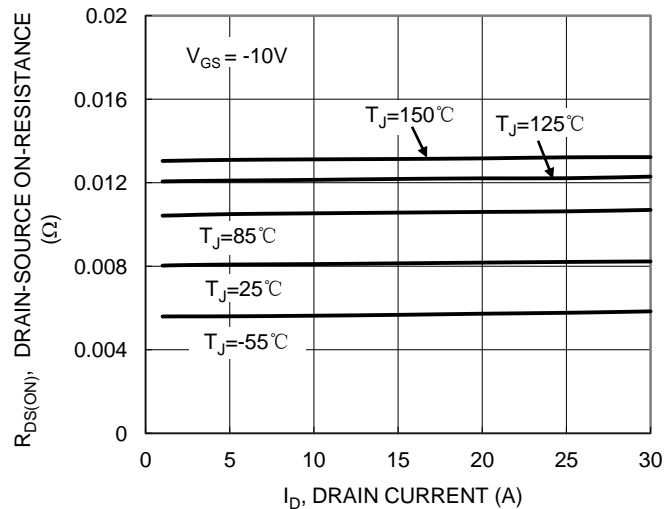


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

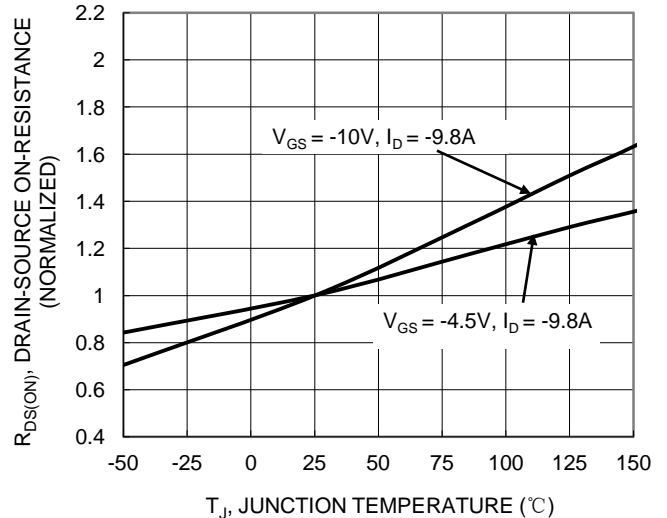
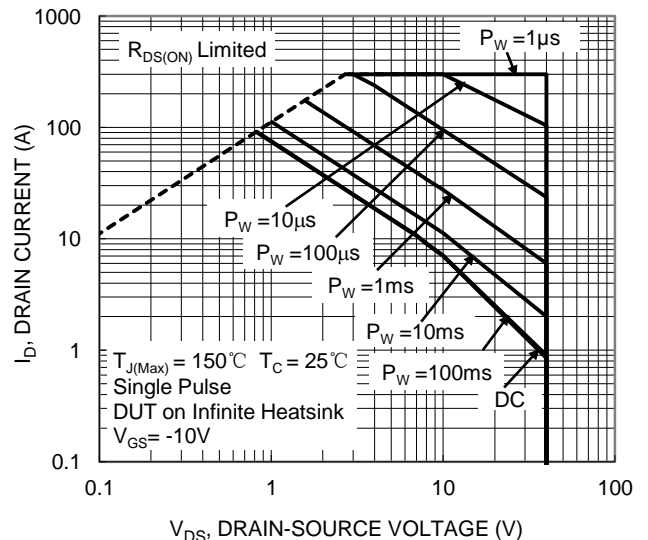
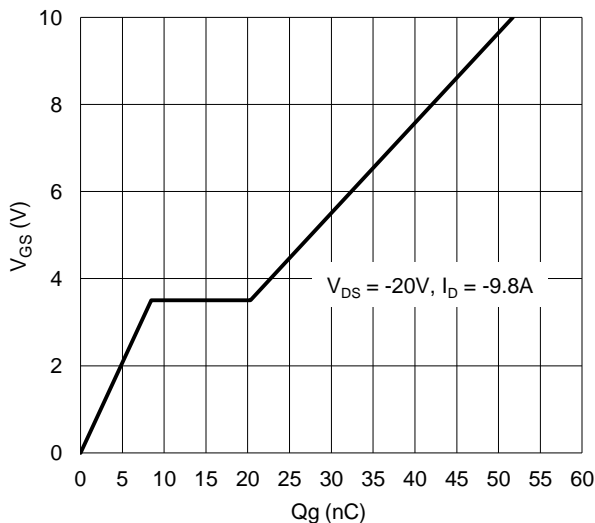
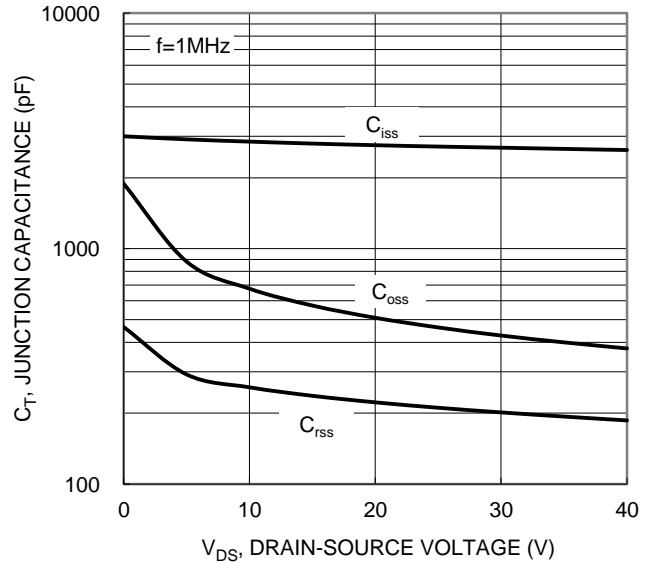
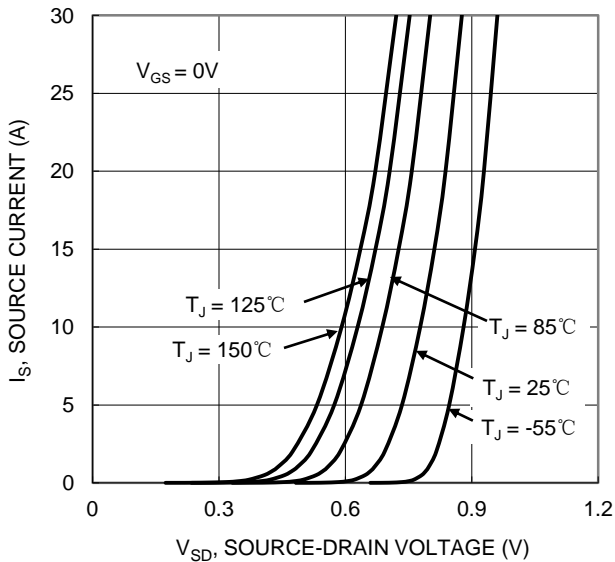
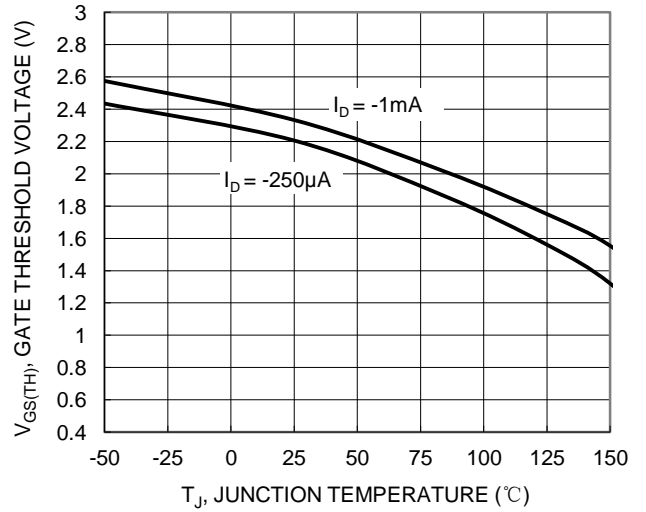
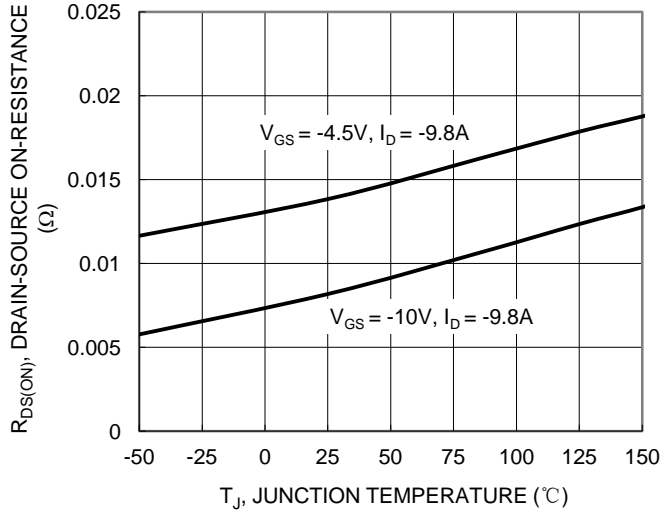


Figure 6. On-Resistance Variation with Temperature



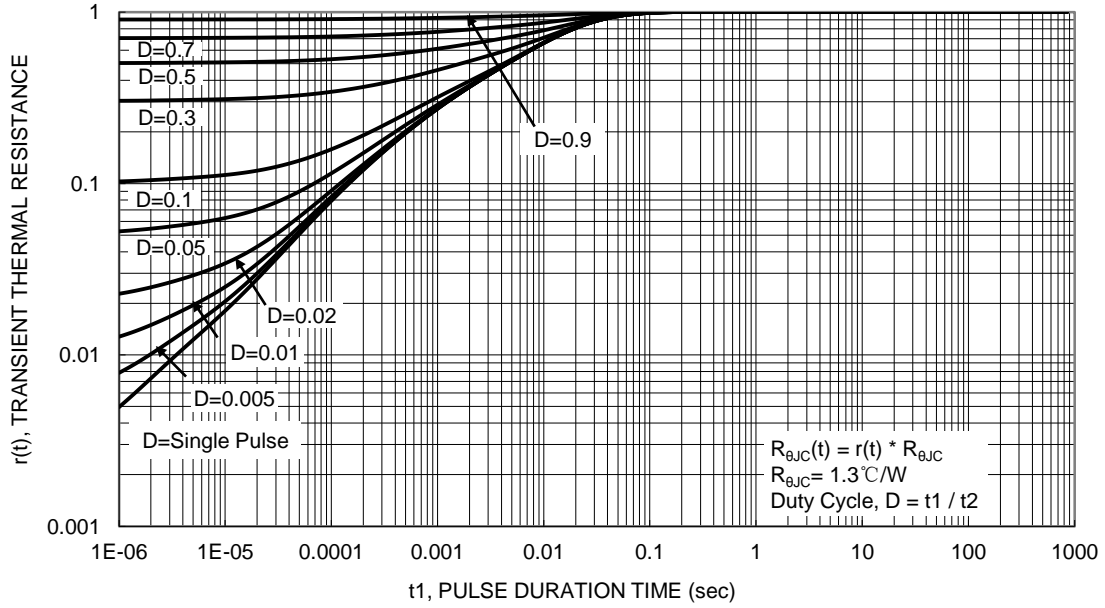
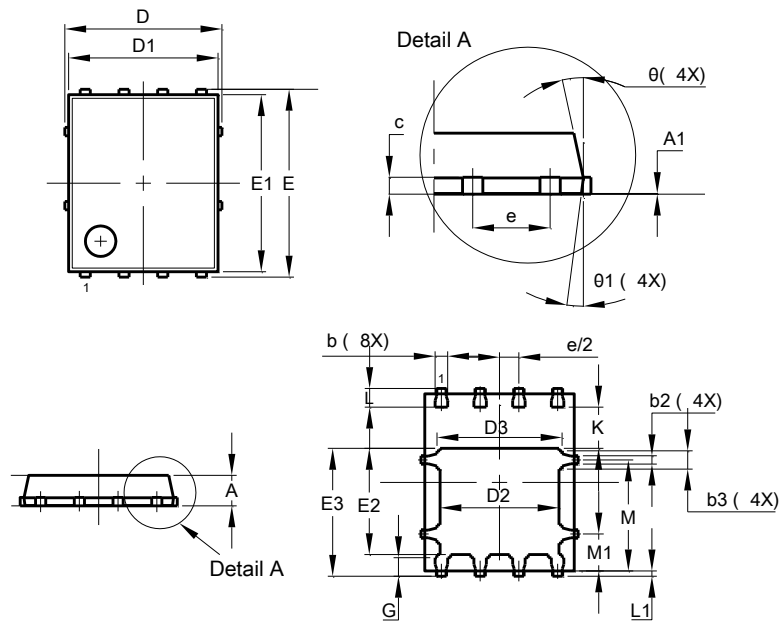


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**PowerDI5060-8**



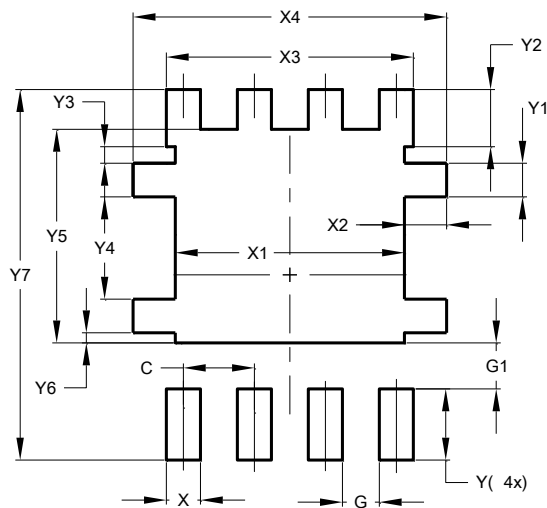
PowerDI5060-8			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0.00	0.05	—
b	0.33	0.51	0.41
b2	0.200	0.350	0.273
b3	0.40	0.80	0.60
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.70	4.10	3.90
D3	3.90	4.30	4.10
E	6.15 BSC		
E1	5.60	6.00	5.80
E2	3.28	3.68	3.48
E3	3.99	4.39	4.19
e	1.27 BSC		
G	0.51	0.71	0.61
K	0.51	—	—
L	0.51	0.71	0.61
L1	0.100	0.200	0.175
M	3.235	4.035	3.635
M1	1.00	1.40	1.21
$\theta$	10°	12°	11°
$\theta_1$	6°	8°	7°

All Dimensions in mm

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**PowerDI5060-8**



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	4.100
X2	0.755
X3	4.420
X4	5.610
Y	1.270
Y1	0.600
Y2	1.020
Y3	0.295
Y4	1.825
Y5	3.810
Y6	0.180
Y7	6.610

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